

# **SOIL-GAS SAMPLING AND ANALYSIS AT PRESENT AND FORMER DRY-CLEANING PROPERTIES IN LAS CRUCES, NEW MEXICO, JUNE, 2002**

## **INTRODUCTION**

Tetrachloroethylene (PCE) contamination has been found in ground water at the Griggs and Walnut Ground-Water Plume Superfund site in Las Cruces, New Mexico. The U.S. Environmental Protection Agency (USEPA) is performing a contaminant-source investigation for the site. Potential sources of PCE include former and current dry-cleaning properties near the area of known PCE contamination in ground water. The USEPA asked the U.S. Geological Survey, New Mexico District (USGS), to perform soil-gas surveys at eleven former and present dry-cleaning properties to determine if PCE vapor is present in soil and to help determine the general extent of PCE contamination.

## **METHODS**

### **Direct-Push Sampling**

A model 6610DT Geoprobe was used to obtain soil-gas samples. The Geoprobe's hydraulic pressure and hammer action was used to advance hollow steel drill rod (2-inch outside and 0.75-inch inside diameters) into the soil. No special tools were required to drive the drill rod through asphalt. The leading end of the drill rod was equipped with an expendable steel tip and the threaded drill rod joints were sealed using Gas Teflon tape to prevent the introduction of ambient air into the soil-gas samples. Drill rod was advanced into the soil to a depth of about 12 feet. The drill rod was then pulled up about 4 inches leaving the expendable tip and exposing the leading end of the drill rod to soil gas. Teflon sample tubing, fitted with a sampling septum, was then connected to the top of the drill rod using a hose fitting adapter screwed onto the outside of the drill rod. The other end of the sample tubing was attached to a reservoir tank and vacuum pump assembly. The vacuum pump was used to pull soil gas from the soil through the drill rod and sample tubing. The drill rod and sample tubing were purged for 5 minutes to insure obtaining a

representative sample of soil gas. A graduated gas-tight syringe was used to obtain soil gas for analysis (see below).

After sampling and analysis was complete, the sampling apparatus was disconnected and the drill rods were removed from the borehole. The borehole was then filled with 0.25-inch bentonite pellets to within 4 inches of land surface. The top 4 inches were filled with soil or cold-patch asphalt, as appropriate.

### **Soil Gas Analysis**

Soil gas samples were analyzed using a Photovac model 10S-50 portable gas chromatograph (GC). The GC was operated on site during the first two days of sampling and at a fixed location off site during the third day of sampling. During the first two days of sampling, samples were collected through a septum on the sample tubing using a gas-tight syringe. The contents of the gas-tight syringe were injected directly into the GC for analysis. During the third day of sampling, samples were collected into Tedlar gas-collection bags using a peristaltic pump connected to the geoprobe sample tubing. Gas-collection bags containing samples were then transported to the GC location where gas samples were drawn into a gas-tight syringe through a septum in the bag. The contents of the gas-tight syringe then were injected into the GC for analysis.

The standard used for GC calibration was prepared by adding 5 microliters of a 200 microgram per milliliter liquid PCE standard solution in methanol (1 ug of PCE) to 20 milliliters of organic-free water contained in a 40-milliliter vial. The vial was closed immediately after addition of the PCE standard solution using a cap containing a septum through which vapor could be extracted from the vial headspace into a gas-tight syringe. The vial and contents were vigorously shaken for five minutes after closure to insure equilibration of PCE between the vapor and aqueous phases before a PCE standard was withdrawn from the vial headspace. Assuming conservation of mass of PCE and using a value of 0.63 for the dimensionless form of the Henrys' Law coefficient for PCE at 25 degrees Celsius (Roger Lee, U.S. Geological Survey, written commun., 2002) yields a vapor phase concentration of 19.3 ug/L for the PCE standard.

A PCE standard was prepared and analyzed at the start of each day of sampling to quantify the response of the GC to and monitor the retention time of PCE. Subsequent standards were analyzed at the start and end of sampling at each site to monitor temperature-related changes in the retention time of PCE.

The detection limit for PCE in the vapor phase under the stated conditions is estimated to be 0.1 ug/L. A reporting limit of 0.2 microgram per liter has been adopted for this report. Concentrations of PCE in soil vapor samples normalized for instrument gain and sample injection volume and reported relative to the PCE standard are given in table 1. The method error for PCE concentrations given in table 1 is semi-quantitative and estimated to be  $\pm 10$  percent of the reported concentration.

## **RESULTS**

A total of 21 soil-gas samples were collected at eleven current or former dry-cleaning sites. One to three samples were collected at each site (table 1). PCE was not detected at SG-3 and SG-4 (Main Street Auto Sales), SG-9 (Library) and SG-15 (Water Street parking lot). PCE was detected at concentrations less than the reporting limit at SG-8 (Library), SG-13 and SG-14 (Water Street parking lot), and SG-18 (Alameda Cleaners). PCE concentrations larger than the reporting limit ranged from 0.35 ug/L at SG-19 (Alameda Cleaners) to 250 ug/L at SG-5 (Church on Main Street) and 390 ug/L at SG-17 (Comet Cleaners). The median PCE concentration was 0.63 ug/L.

**Table 1. Soil-gas site numbers and names, sample numbers and locations, and PCE concentrations for samples obtained at present and former dry cleaners in Las Cruces, New Mexico, June 27, 28, and July 2, 2002 [J, value estimated – result is less than the reporting limit; NAD83, North American Datum of 1983; <, analyte not detected at a concentration greater than the detection limit of 0.1 ug/L]**

Site Number and Name	Sample Number	Sample Location, in degrees minutes seconds (datum is NAD83)		PCE concentration <sup>1</sup> , in ug/L
		Latitude	Longitude	
Site 1: Strip Mall	SG-1	32 19 01.713	106 46 52.173	0.63
Site 1: Strip Mall	SG-2	32 19 21.772	106 46 52.633	6.0
Site 2: Main Street Auto Sales	SG-3	32 19 05.627	106 46 53.233	<0.1
Site 2: Main Street Auto Sales	SG-4	32 19 05.952	106 46 53.262	<0.1
Site 3: Church on Main Street	SG-5	32 18 52.366	106 46 49.608	250
Site 4: Linen Supply/Moose Lodge	SG-6	32 18 48.476	106 46 44.531	11
Site 4: Linen Supply/Moose Lodge	SG-7	32 18 47.829	106 46 44.380	19
Site 5: Library	SG-8	32 18 54.569	106 46 40.761	0.13 J
Site 5: Library	SG-9	32 18 52.560	106 46 40.424	<0.1
Site 6: Sun-Times/Cothren Cleaners	SG-10	32 18 40.593	106 46 50.942	8.6
Site 6: Sun-Times/Cothren Cleaners	SG-11	32 18 40.586	106 46 51.412	3.2
Site 6: Sun-Times/Cothren Cleaners	SG-12	32 18 40.907	106 46 51.678	32
Site 7: Water Street Parking lot	SG-13	32 18 35.192	106 46 49.402	0.17 J
Site 7: Water Street Parking lot	SG-14	32 18 35.808	106 46 49.475	0.14 J
Site 7: Water Street Parking lot	SG-15	32 18 36.326	106 46 49.570	<0.1
Site 8: 125 Griggs Street	SG-16	32 18 33.439	106 46 44.776	33
Site 9: Comet Cleaners	SG-17	32 18 39.521	106 45 29.939	390
Site 10: Alameda Cleaners	SG-18	32 18 15.065	106 46 42.196	0.13 J
Site 10: Alameda Cleaners	SG-19	32 18 14.806	106 46 42.126	0.35
Site 11: Post Office	SG-20	32 18 42.945	106 46 38.378	0.74
Site 11: Post Office	SG-21	32 18 43.496	106 46 38.503	0.53

<sup>1</sup>Concentrations rounded to two significant figures.

## HENRY'S LAW, AND STANDARDS COMPUTATIONS, AND SITE RESULTS

### Henry's Law

Henry's law Conversions	Headspace Conc in ppb v/v @ 25 deg C	Headspace Conc in Gas	Conc in gas	Conc	Conc in gas	Conc in gas
Conc. in water	$k \text{ (atm-m}^3\text{/mol)}^* \cdot 1000 \text{ (L/m}^3)^* \cdot C \text{ (ug/L)}/0.165820 \text{ (ug/mole)}$	Conc. In Gas	ug/L	ppb V/V	ppb V/V	ug/L
ug/L	ppb V/V	ug/L	ug/L	ppb V/V	ppb V/V	ug/L
1	92	0.63	1	147.4	10	0.07
5	461	3.13	5	737.2	50	0.34
10	923	6.26	10	1474.5	100	0.68
20	1845	12.52	20	2949.0	500	3.38
30	2768	18.77	30	4423.5	1000	6.77
40	3691	25.03	40	5898.0	5000	33.84
50	4613	31.29	50	7372.5	10000	67.68
100	9227	62.58	100	14744.9	50000	338.41

### Standards

Standard	add	volume	Conc	Conc	Henry's K	Conc in Headspace	Conc in Headspace
1 ug PCE in 20 ml H2O with 20 ml headspace 30.8 ug/L aq; 19.3 ug/L in headspace	grams	Liters	ug/L	moles/L	Atm-L/mole	ppb V/V	ug/L
	1E-06	0.02	30.8	1.8574E-07	15.3	2842	19.3

## Site Results

Sample no. and date	Time	Latitude		Longitude		Photovac 10S		PCE integration, mVS	Concentration		Comments
		degrees	minutes	seconds,	Gain	Injection Volume, uL	ug/L in gas		ppb V/V		
6/27/2002											
50 ug std					50	50	7700	19.30	2845.8	5 uL of 200 ug/ml std in 20 ml water in 40 ml VOA vial	
SG-1	910	32 19 01.713	106 46 52.173	100	200	2000	0.63	92.4	sample 1 at strip mall		
SG-2	930	32 19 21.772	106 46 52.633	100	50	4800	6.02	887.0	sample 2 at strip mall		
SG-3	1454	32 19 05.627	106 46 53.233	250	100	36	0.01	1.3	Sample South Main St. Auto Sales		
SG-4	1515	32 19 05.952	106 46 53.262	250	100	Non Detect	<0.1	<14.745	Sample North Main St. Auto Sales		
SG-5	1603	32 18 52.366	106 46 49.608	20	10	8100	253.78	37420.2	Sample behind church on Main St.		
6/28/2002											
50 ug std					50	50	8100	19.30	2845.8	5 uL of 200 ug/ml std in 20 ml water in 40 ml VOA vial	
SG-6	809	32 18 48.476	106 46 44.531	100	20	3700	11.02	1624.9	Site 4--Linen Supply/Moose Lodge		
SG-7	845	32 18 47.829	106 46 44.380	100	20	6500	19.36	2854.6	Site 4--Linen Supply/Moose Lodge		
SG-8	951	32 18 54.569	106 46 40.761	250	100	530	0.13	18.6	Site 5--Library		
SG-9	1030	32 18 52.560	106 46 40.424	250	100	350	0.08	12.3	Site 5--Library		
SG-10	1200	32 18 40.593	106 46 50.942	100	20	2900	8.64	1273.6	Site 6--Sun-Times/Cothren Cleaners		
SG-11	1220	32 18 40.586	106 46 51.412	100	50	2700	3.22	474.3	Site 6--Sun-Times/Cothren Cleaners		
SG-12	1250	32 18 40.907	106 46 51.678	100	20	10900	32.46	4786.9	Site 6--Sun-Times/Cothren Cleaners		
SG-13	1332	32 18 35.192	106 46 49.402	250	100	720	0.17	25.3	Site 7-Water St. Parking lot		
SG-14	1350	32 18 35.808	106 46 49.475	250	100	580	0.14	20.4	Site 7-Water St. Parking lot		
SG-15	1410	32 18 36.326	106 46 49.570	250	100	330	0.08	11.6	Site 7-Water St. Parking lot		
SG-16	1501	32 18 33.439	106 46 44.776	50	20	5500	32.76	4830.8	Site 8--125 Griggs		
SG-17	1657	32 18 39.521	106 45 29.939	20	2	2600	387.19	57091.4	Site 9 Comet Cleaners		
7/2/2002											
50 ug std					50	20	8400	19.30	2845.8	5 uL of 200 ug/ml std in 20 ml water in 40 ml VOA vial	
Pump Blk					50	250	240	0.04	6.5		
SG-18	844	32 18 15.065	106 46 42.196	50	250	700	0.13	19.0	Alameda Cleaners		
SG-19	905	32 18 14.806	106 46 42.126	50	250	1900	0.35	51.5	Alameda Cleaners		
SG-20	1319	32 18 42.945	106 46 38.378	50	250	4000	0.74	108.4	Post Office		
SG-21	1340	32 18 43.496	106 46 38.503	50	250	2900	0.53	78.6	Post Office		